

BRAHMS Multiplicity Array

- Why BRAHMS?
- Role of Multiplicity Array
- Design constraints and goals
- Hybrid Array
- The problem of modest segmentation
- GEANT simulations
- Current Status

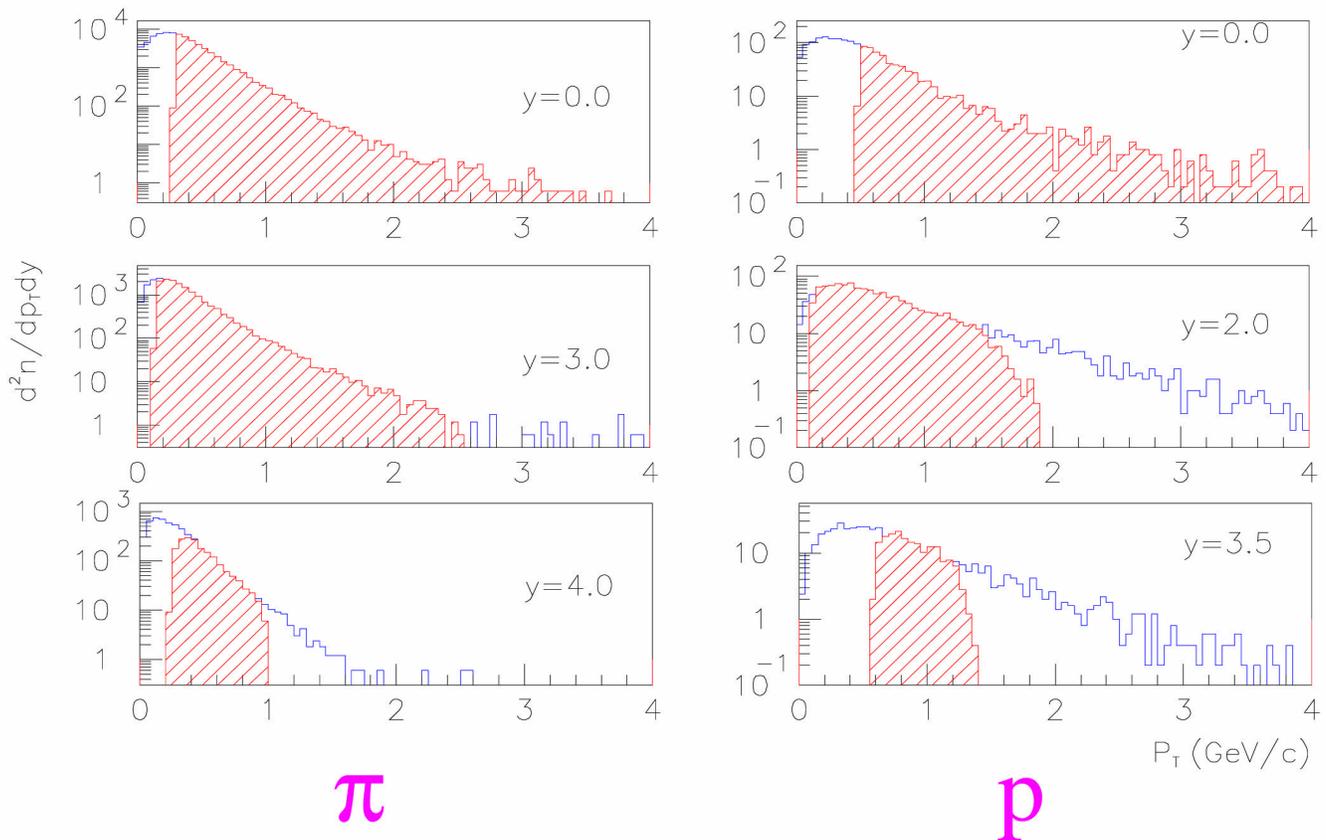
Broad Range Hadron Magnetic Spectrometers

- **Physics Goals**

- Study reactions mechanisms at RHIC energies:
 - Stopping
 - Expansion and freeze-out
- Search for evidence of QGP

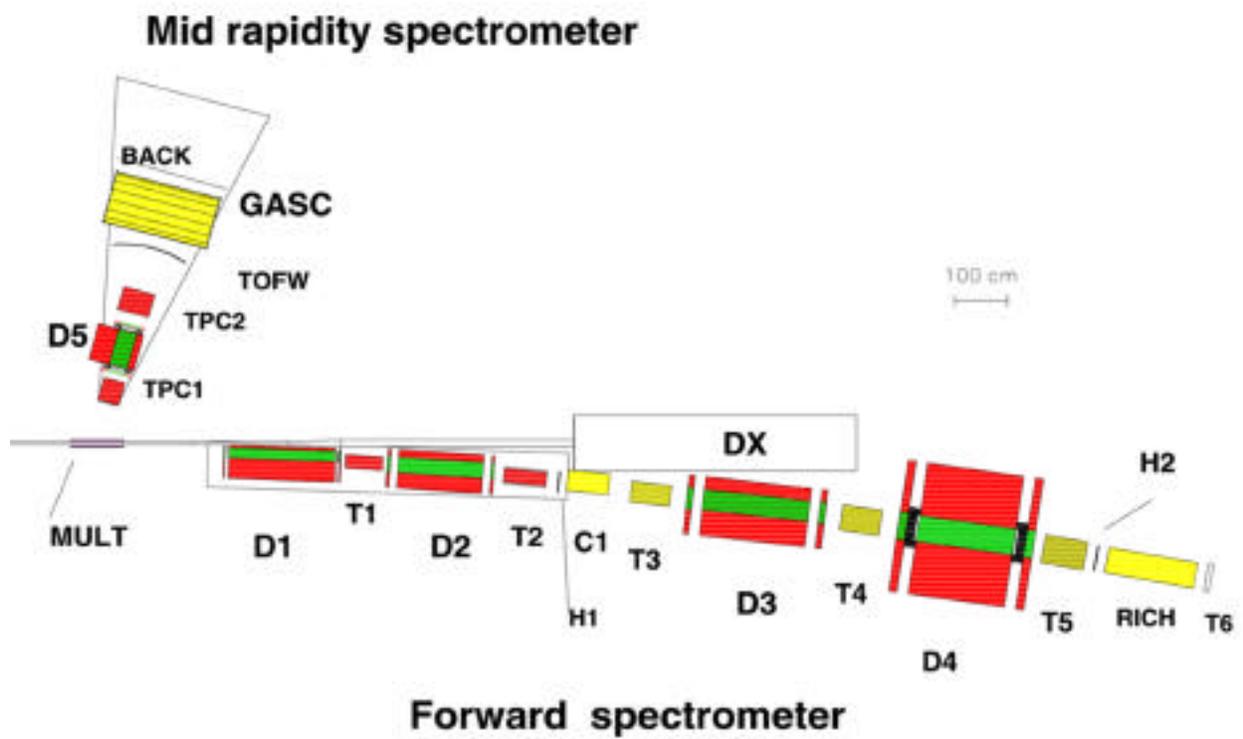
- **Measurement Goals**

- Measure and identify charged hadrons over a wide range of rapidity and transverse momenta



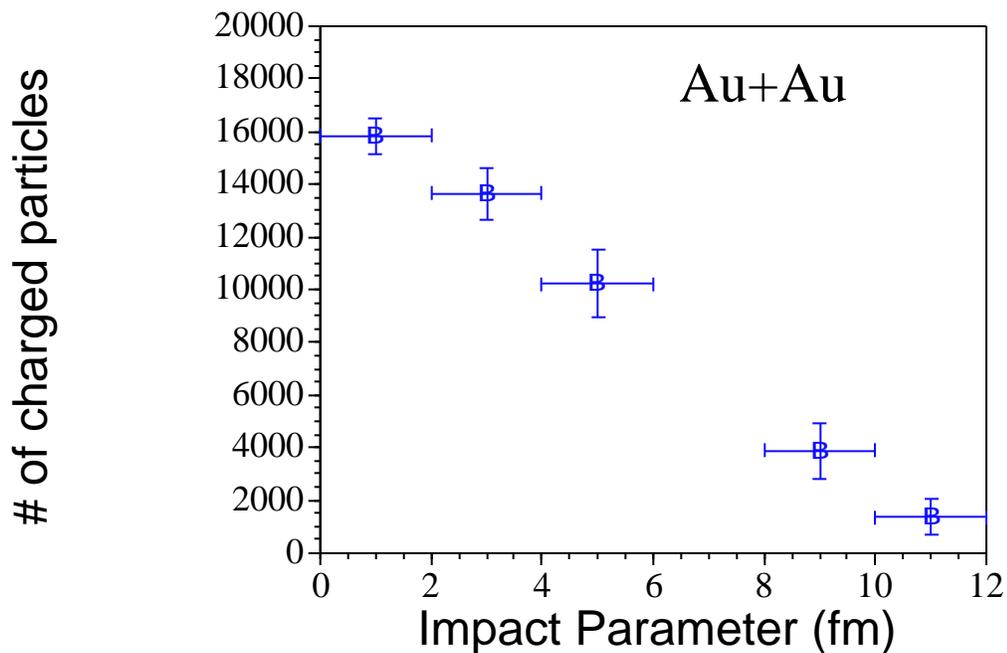
Histograms : Generated P_T distributions
hatched : Accepted at BRAHMS detectors

General Layout of BRAHMS



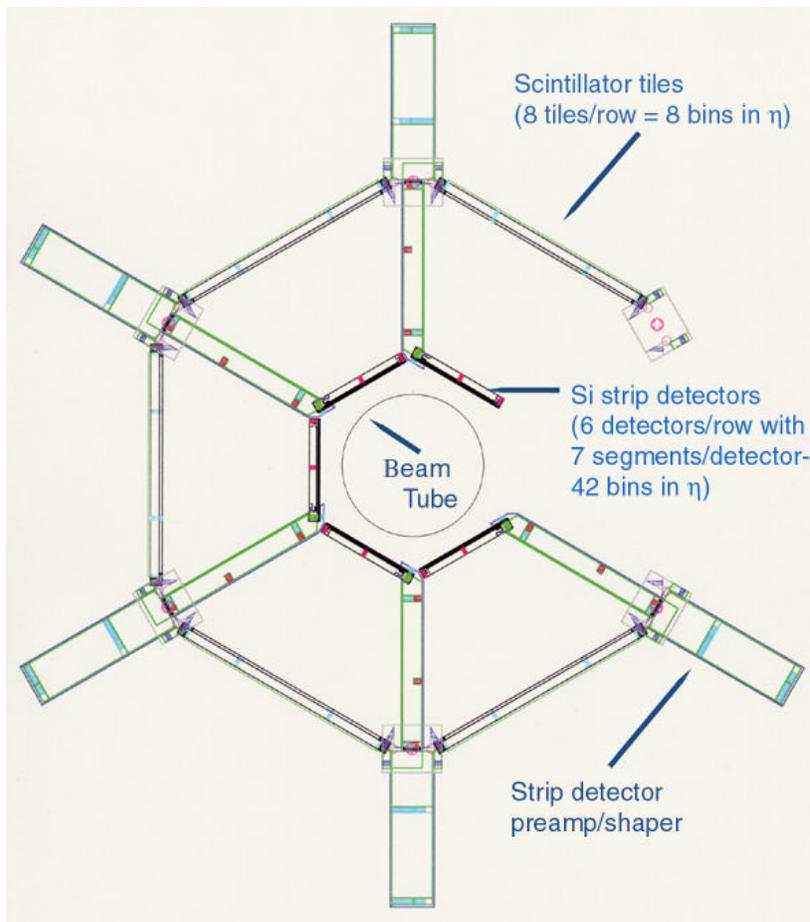
Multiplicity Array Functions

- Characterize dn/d
- Characterize event centrality

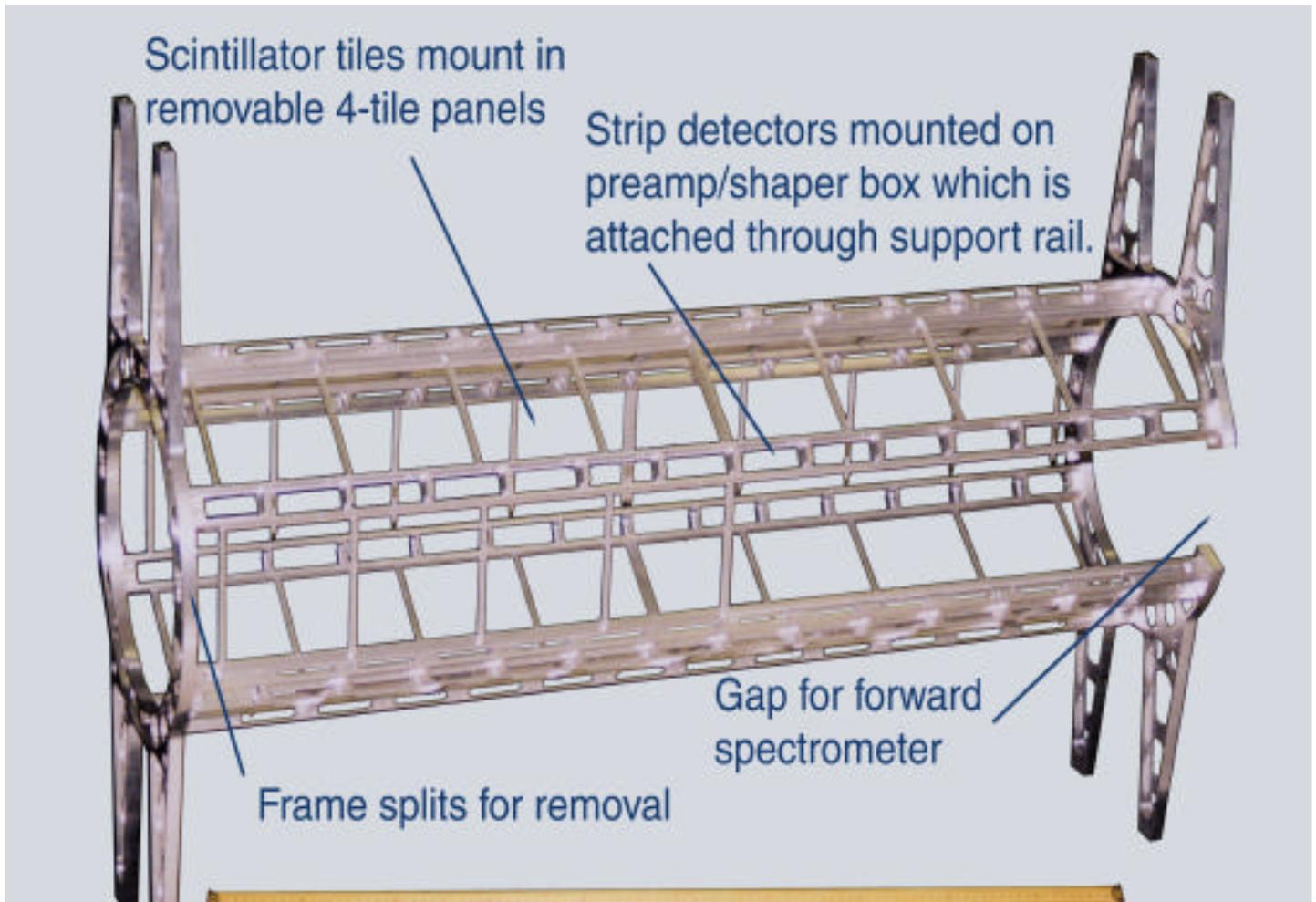


- 1st Level Trigger for Event Downscaling (0th Level from beam-beam counters)

- Design constraints and goals
 - “Reasonable” segmentation in pseudorapidity (angle).
 - Event selection <250 ns.
 - “Low” cost.
 - Acceptable secondary rates in spectrometers.
- Hybrid Array
 - # particle = (Detected Energy)/ $\langle E_{\text{MIP}} \rangle$
 - Plastic scintillator tiles with fiber-optic readout for event selection.
 - Si strip detectors for off-line multiplicity and dn/d determination.



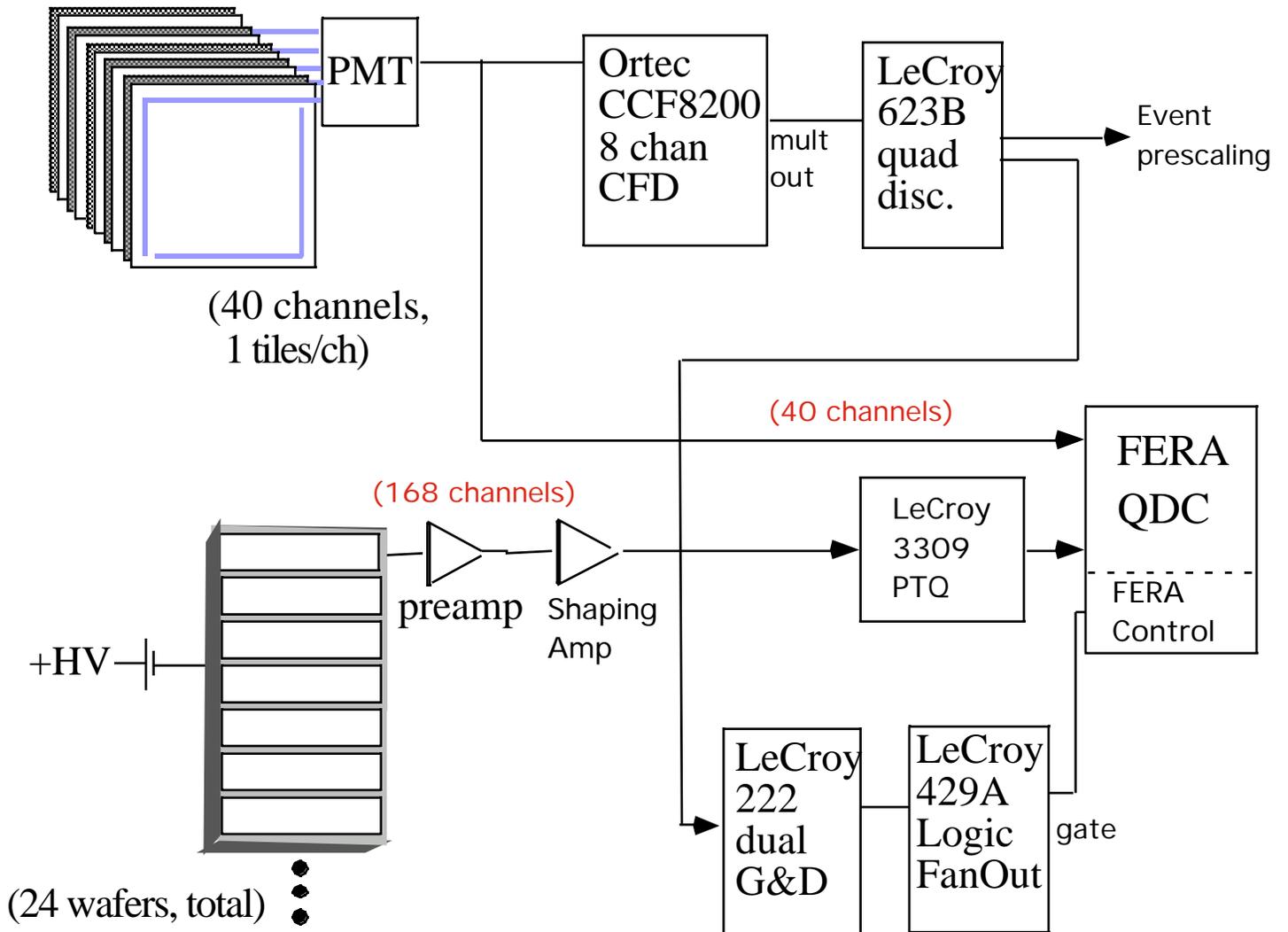
Mounting frame for multiplicity array.



Initial Configuration:

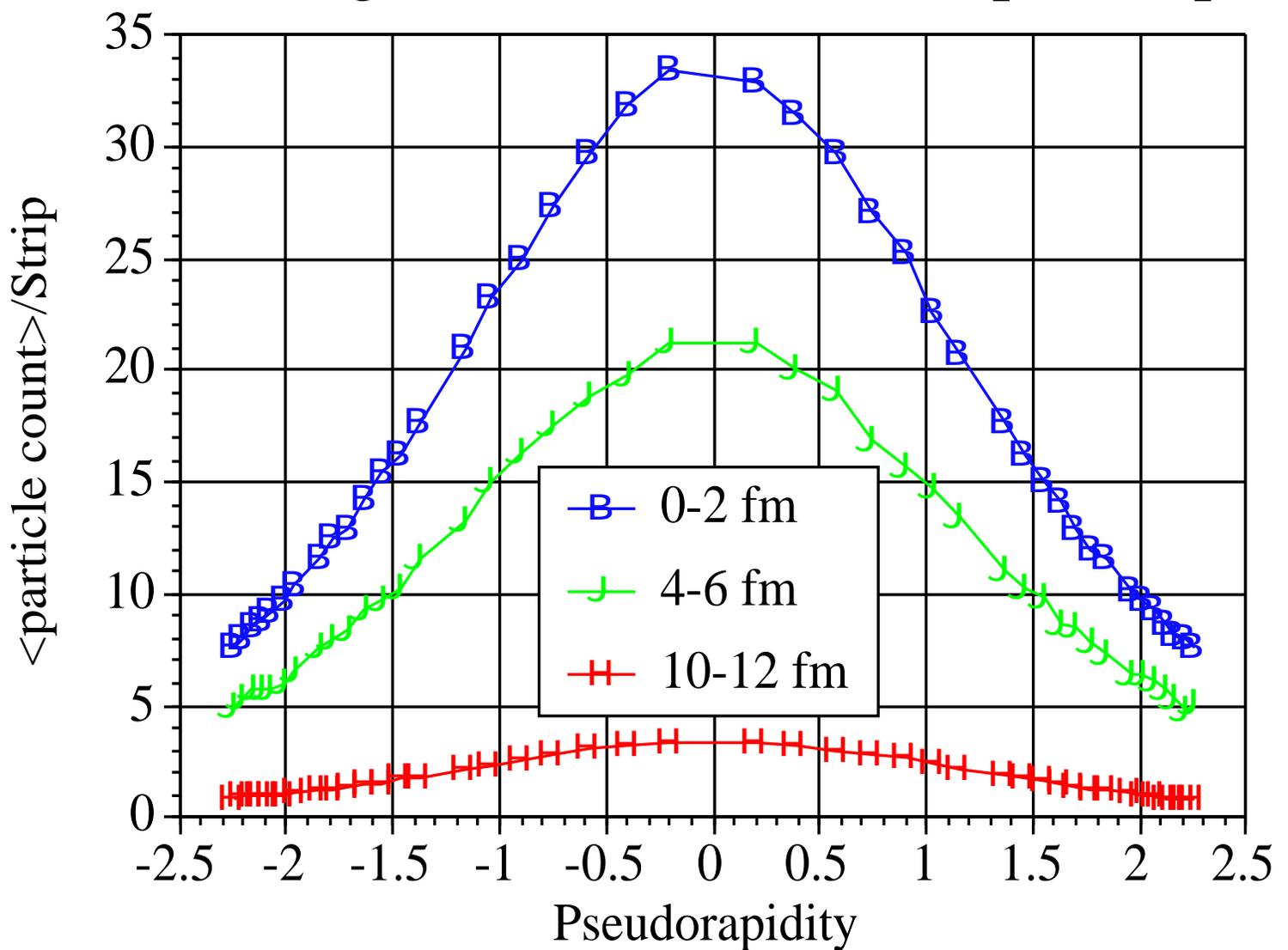
24 Si strip detectors: 6cm x 4cm/7 strips per wafer
40 scintillator tiles: 12cm x 12cm

Electronics

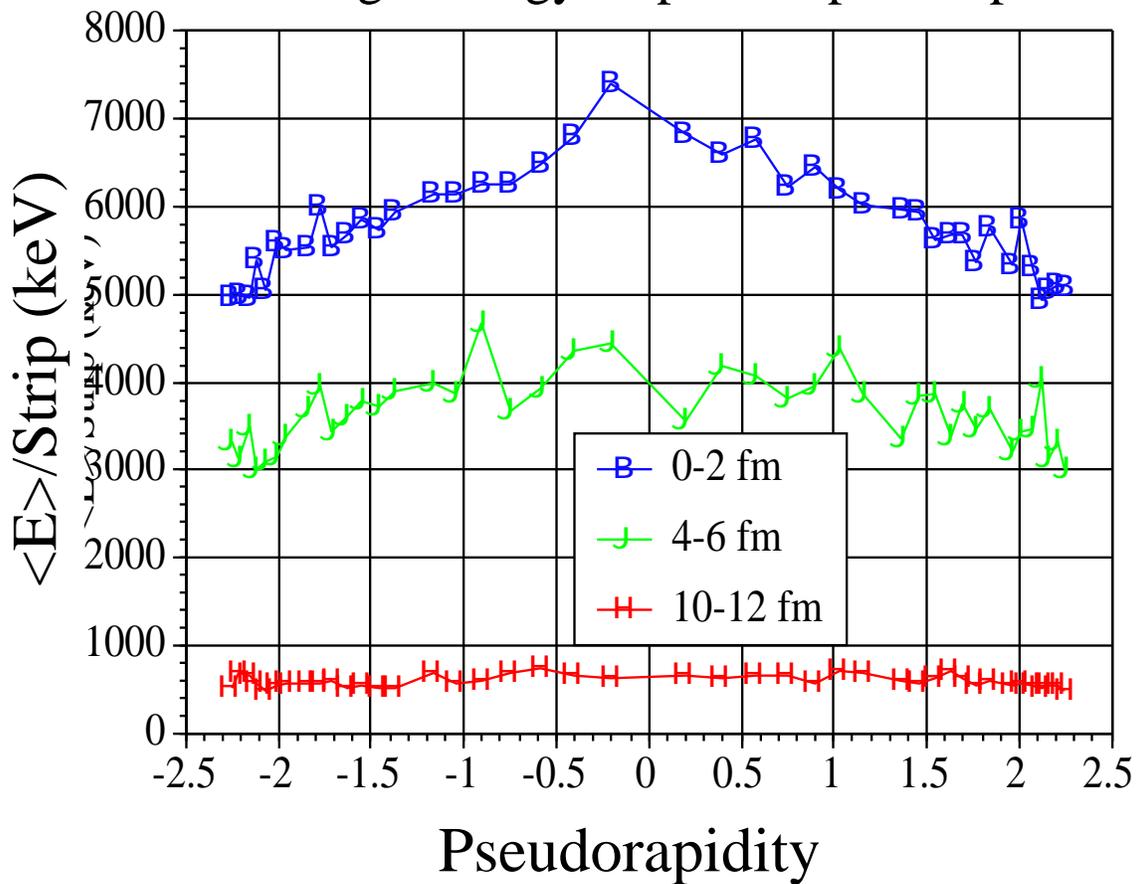


Performance based on GEANT simulations. Au+Au scattering.

Average Number of Particles per Strip

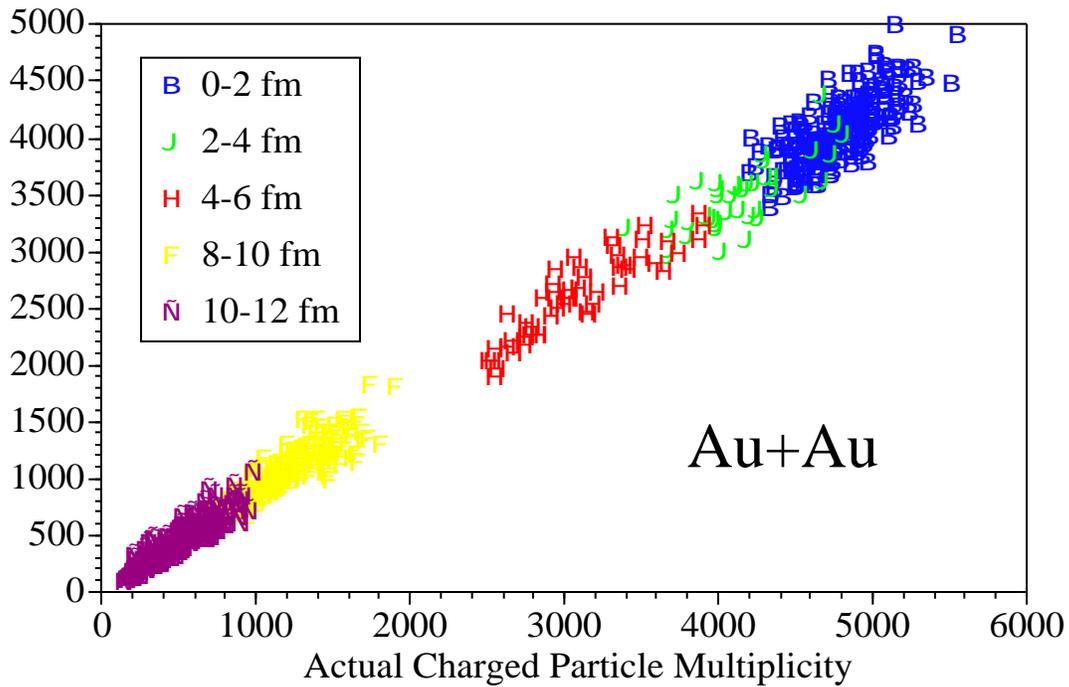


Average Energy Deposited per Strip

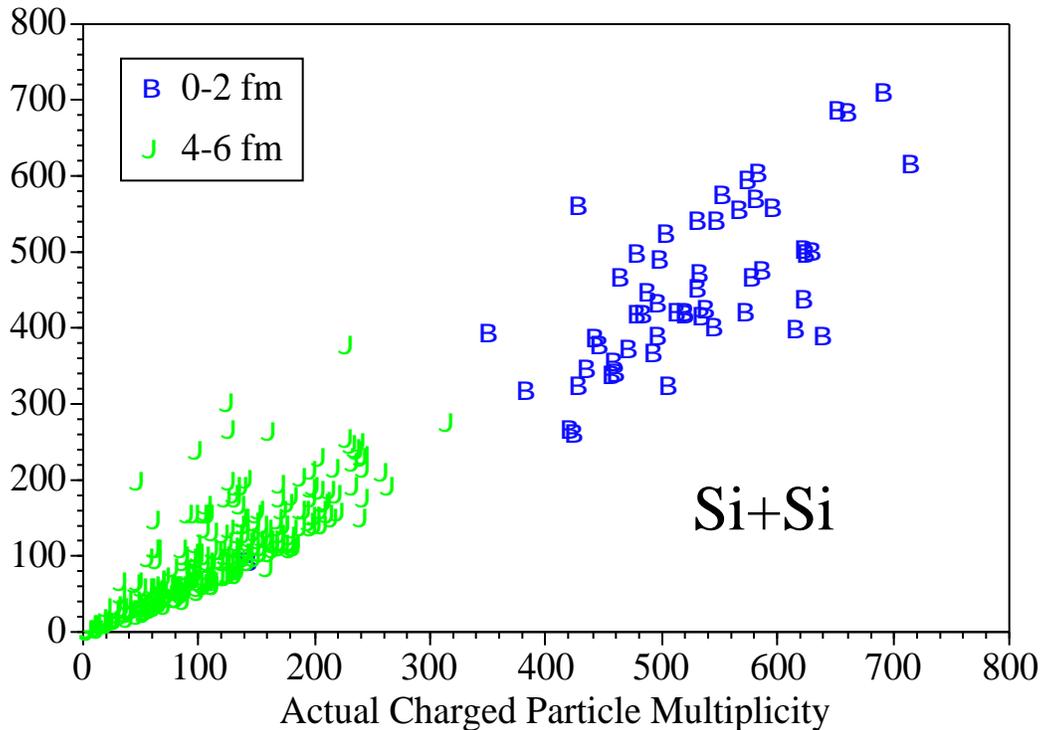


Multiplicity Array Response— Strip Detectors, only

"Measured" Charged Particle Multiplicity

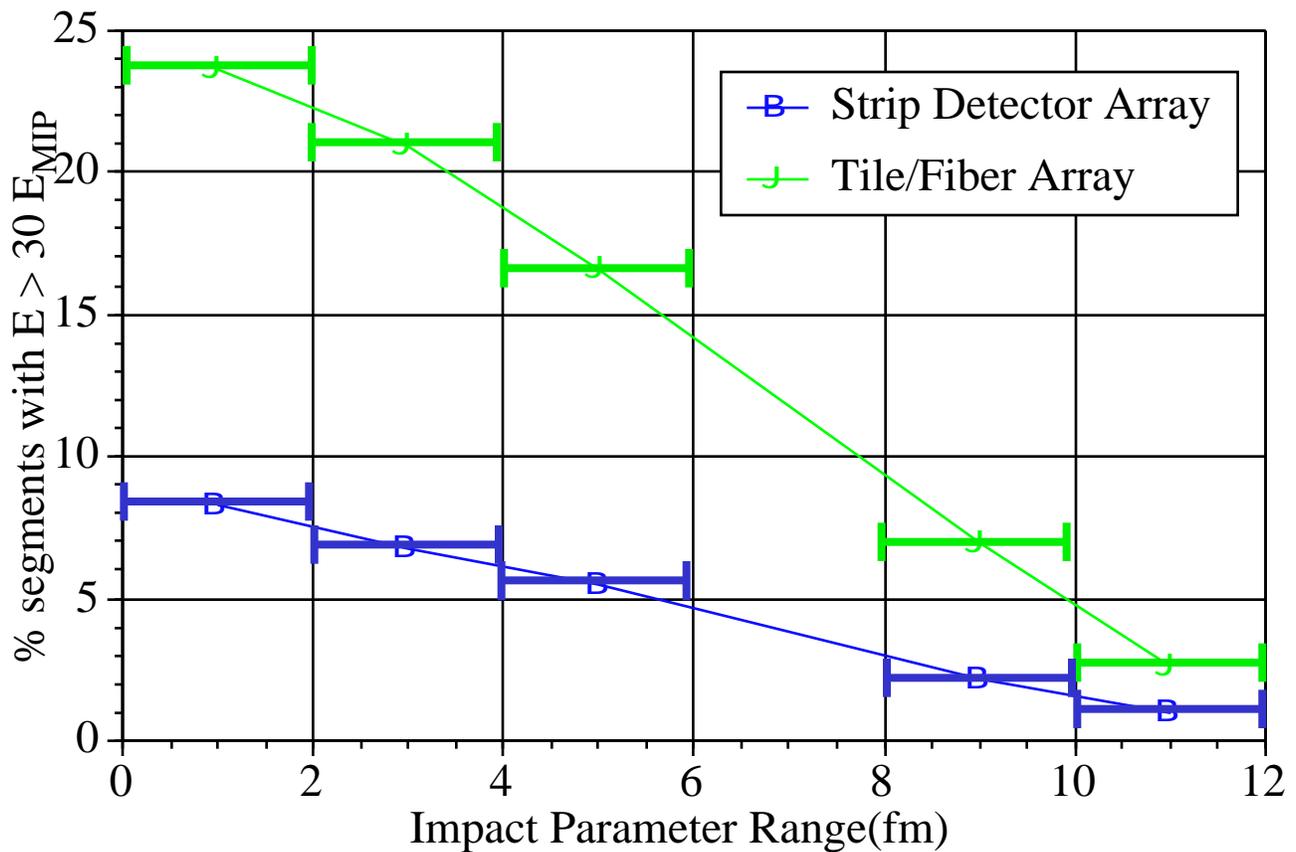


"Measured" Charged Particle Multiplicity



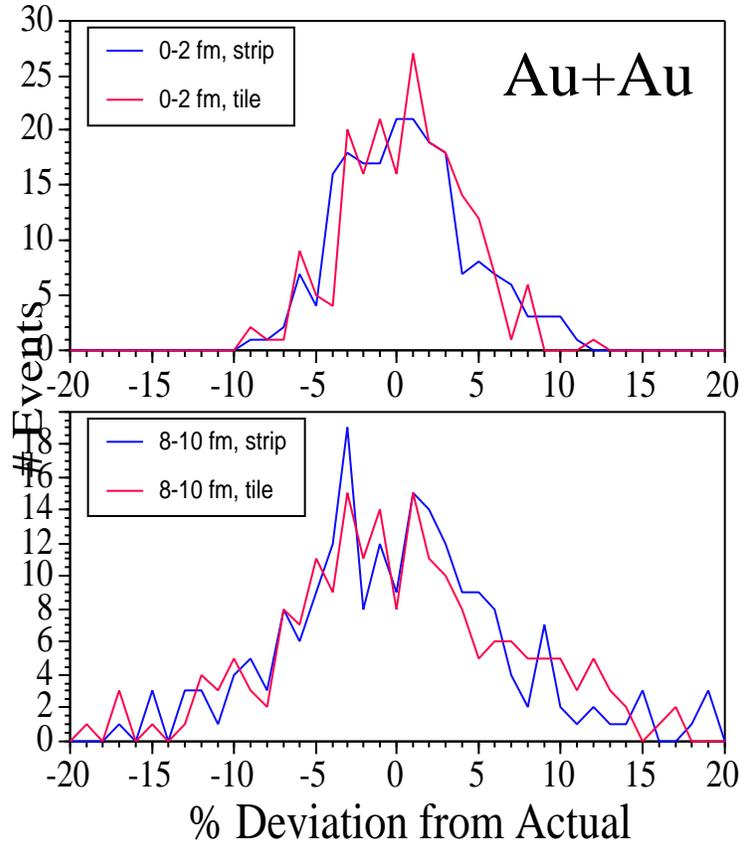
(Scintillators behave similarly.)

The problem with modest segmentation...



Most high-energy deposition events arise from secondary scattering within multiplicity array, itself. Correction possible using unaffected array elements.

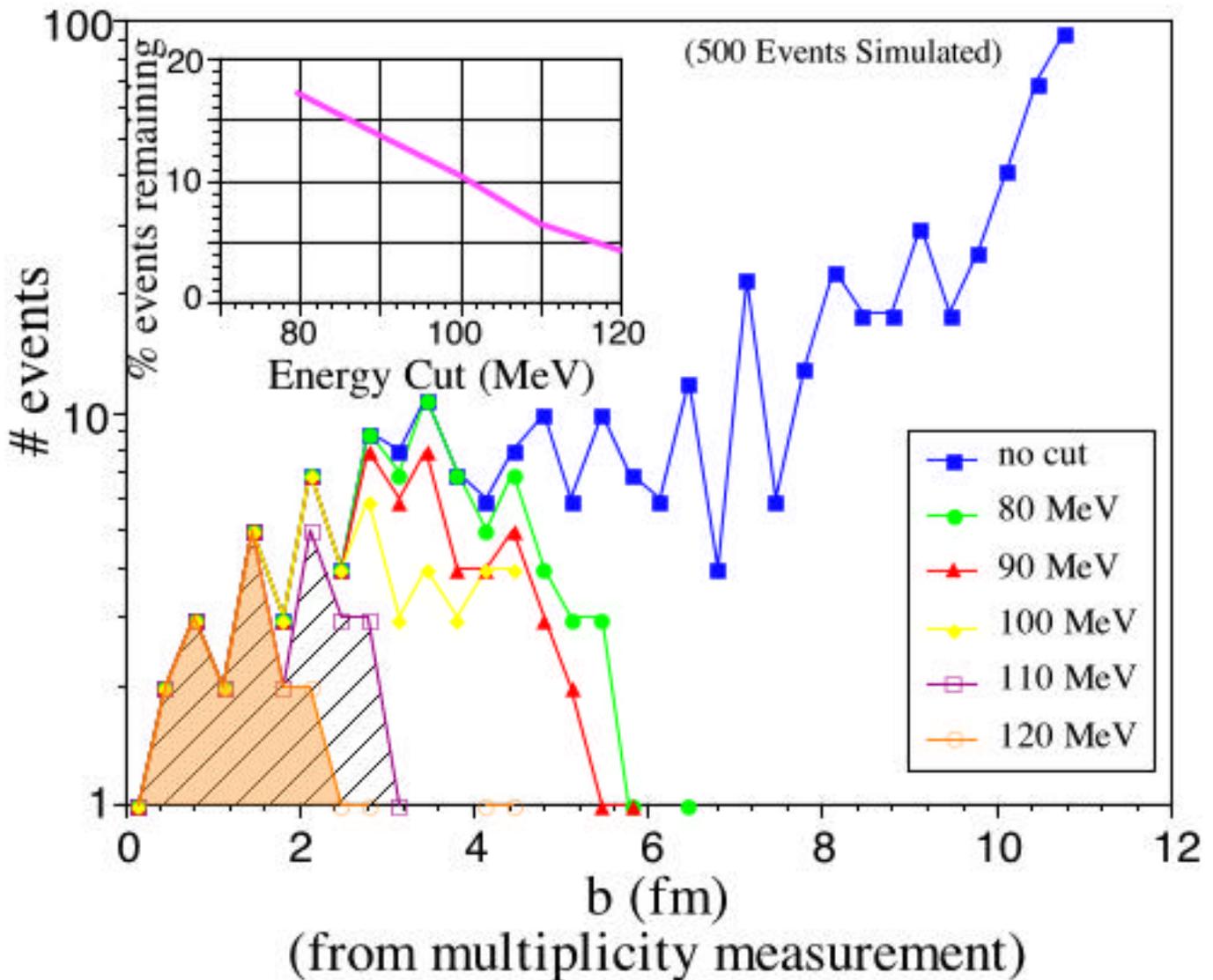
Expected performance based on GEANT simulations



Detector	TPC Primary Counts (per central event)	TPC Secondary Counts (per central event)	Accuracy (Au+Au) - (% deviation) 0-2 fm	Accuracy (Au+Au) - (% deviation) 8-10 fm	Accuracy (Si+Si) - (% deviation) 0-2 fm	Accuracy (Si+Si) - (% deviation) 4-6 fm
Hybrid	78	29				
strips			4.2	8.2	8.9	40.0
tiles			4.2	8.0	10.4	51.0
(strips+tiles)			3.4	6.4	7.5	33.0
no array	78	23				

Effectiveness for on-line event selection

events with the summed energy of 8 tiles greater than the indicated threshold as a function of the actual multiplicity.



Status

- **Tasks completed**
 - Scintillator tiles with fiber optic wavelength shifting cables built and tested. (Y.K. Lee-Johns Hopkins, R. Debbe-BNL)
 - Framework completed.
 - Strip detectors ordered from Micron Semiconductor, 8 of 26 in hand.
 - Full prototype of strip detector preamp/shaper electronics built and tested. (<60 keV FWHM resolution)
- **Still needed**
 - Delivery of Hamamatsu H3178-51 phototube assemblies. (June run.)
 - Floor stand for array. (June run.)
 - Remaining strip detectors. (End-of-year run.)
 - Production version of preamp/shaper electronics. (End-of-year run.)